Current Condition of Streams in the Shenandoah River Drainage of the Lee Ranger District, George Washington-Jefferson National Forest, Virginia

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Introduction

Throughout the summer of 2001 we conducted stream habitat surveys on Shenandoah River drainage streams within the Lee Ranger District, George Washington-Jefferson National Forest (GWJNF), Virginia, to quantify stream habitat conditions. Over 140 kilometers (88 miles) of stream habitat (40 streams) was classified and inventoried between 28 May and 23 August 2001, using Basinwide Visual Estimation Techniques (BVET) (Dolloff et. al 1993). In addition, we completed two habitat surveys in summer 2002. We were unable to complete surveys on three streams due to small stream size or stream access problems.

We modified standard BVET methods to measure stream habitat parameters identified in the GWJNF forest plan. Included in the forest plan is an outline of the desired-future-condition (DFC) for all the streams within the GWJNF based on physical habitat. The pertinent DFCs for the GWJNF include woody debris loading of 78 to 186 pieces per kilometer and 30 to 70 percent of the total stream habitat in pools. We were able to estimate woody debris loading and percentage of pool and riffle area using BVET habitat survey techniques. In addition, we were able to map the distribution of large woody debris and Rosgen's channel type, and to estimate habitat unit depths, substrates, and the width of the riparian area in all streams surveyed.

The purpose of this report is to describe the current condition of Lee Ranger District streams in a format useful to the Lee Ranger District and the GWJNF. The enclosed report is intended to provide baseline information for Lee Ranger District managers involved in habitat improvement projects or land use decisions.

Methods

Surveys began at confluences for streams confined within National Forest boundaries and at the downstream USFS boundary for all other streams. Surveys were terminated when we encountered an upstream USFS boundary, or when the wetted channel was < 1 m average wetted width for > 500 m.

Two-stage visual estimation techniques were used to quantify habitat and DFCs in selected Lee Ranger District streams. During the first stage, all habitat units were classified and a number of habitat characteristics were estimated for each habitat unit. Habitat was stratified into similar groups based on naturally occurring habitat units including pools (areas in the stream with concave bottom profile, gradient equal to zero, greater than average depth, and smooth water surface), and riffles (areas in the stream with convex bottom profile, greater than average gradient, less than average depth, and turbulent water surface). Glides (areas in the stream similar to pools, but with average depth and flat bottom profile) were identified during the survey but were grouped with pools for data analysis. Runs (areas in the stream similar to riffles but with average depth, less turbulent flow, and flat bottom profile) and cascades (areas in the stream with

> 12% gradient, high velocity, and exposed bedrock or boulders) were grouped with riffles for data analysis. Braids (areas in the stream where multiple channels occur regardless of habitat type) were recorded during the survey but their area was not included in data analysis (braids were encountered in only three streams).

Habitat in each stream was classified and inventoried by a two-person crew. One crew member identified each habitat unit by type (as described above), estimated average wetted width, average and maximum depth, riffle crest depth (RCD), and substrate composition for each habitat unit, and determined if pool substrates were embedded. The length (0.1 m) of each habitat unit was measured with a hip chain. Average wetted width was visually estimated. Average and maximum depth of each habitat unit were estimated by taking depth measurements at various places across the channel profile with a graduated staff marked in 5 cm increments. The RCD was estimated by measuring water depth at the deepest point in the hydraulic control between riffles and pools. The RCD was subtracted from average pool depth to obtain an estimate of residual pool depth. Substrates were assigned to one of nine size classes (see table on next page). Dominant substrate (covered greatest amount of surface area in habitat unit) and subdominant substrate (covered 2nd greatest amount of surface area in habitat unit) were visually estimated. Substrate was considered to be embedded if larger size substrate was embedded by smaller size substrate over greater than 35% of the surface area of the stream bed in a given habitat unit.

The second crew member classified and inventoried large woody debris (LWD) within the stream channel, determined the Rosgen's channel type associated with each habitat unit, and recorded data on a Husky Hunter data logger. LWD was assigned to one of four size classes (see table on next page). All woody debris less than 1 m long and less than 10 cm in diameter were omitted from the survey. Rosgen's channel type was visually estimated using criteria found in Rosgen (1996).

The first unit of each habitat type selected for intensive (second stage) sampling (i.e. accurate measurement of wetted width) was determined randomly. Additional units were selected systematically (every 10th unit for each habitat type). The wetted width of each systematically selected habitat unit was measured with a meter tape across at least three transects. In each of the systematically selected (second stage) riffles we also estimated the bankfull stream channel width and riparian width as described by Harrelson et al. (1994), and measured channel gradient. We estimated bankfull channel width by measuring the width of the bankfull channel perpendicular to flow. We estimated riparian width by measuring from the edge of the bankfull channel to the intersection with the nearest landform at a predetermined flood stage. The flood stage was calculated from a formula specific to Virginia streams, based on watershed area. Gradient was estimated by using a clinometer to site from the downstream to the upstream end of the selected riffle.

We used the ratio of measured to estimated area to develop a calibration ratio, which allowed us to correct visual estimates and estimate stream area with confidence intervals (Hankin and Reeves 1988). BVET calculations were computed with a Microsoft Excel spreadsheet using formulas found in Dolloff et al. (1993). Data were summarized using Excel spreadsheets and SigmaPlot graphics software.

Size classes used to categorize large woody debris during BVET habitat surveys on the Lee Ranger District, summer 2001. Woody debris < 1.0 m in length or < 10 cm in diameter were omitted.

Size Class	Length (m)	Diameter (cm)
1	< 5	10-55
2	< 5	> 55
3	> 5	10-55
4	> 5	> 55

Size classes used to categorize substrate particles during BVET habitat surveys on the Lee Ranger District, summer 2001. Size was visually estimated on the intermediate axis (b-axis).

Size Class	Name	Size (mm)	Description
1	Organic	--	Dead organic matter, leaves, detritus, etc.
2	Clay	< .00024	Sticky
3	Silt	.00024-.0039	Slippery
4	Sand	.0039-2	Gritty
5	Small Gravel	2-10	Sand to thumbnail
6	Large Gravel	11-100	Thumbnail to fist
7	Cobble	101-300	Fist to head
8	Boulder	>300	Larger than head
9	Bedrock	--	Solid parent material

User's Guide

Stream summaries are organized in alphabetical order by stream drainage (North Fork and South Fork Shenandoah River), then by U. S. Geological Survey (USGS) 1:24,000 Topographic Quadrangle, and then by stream name. The upper right hand corner of each page in the 'Stream Summaries' section contains the stream drainage and USGS quadrangle name for the selected stream.

Data for each stream section were collected, analyzed, and presented separately. Each stream or stream section summary contains:

1. a synopsis of stream characteristics;
2. boxplots of maximum and average depth for pools and riffles, and average residual pool depth;
3. LWD per kilometer graph;
4. LWD distribution graph;
5. substrate composition graph for pools and riffles;
6. boxplot of riparian measurements;
7. percent pools and riffles graph; and
8. distribution of Rosgen's channel type graph.

GWJNF's DFCs are indicated on all pertinent graphs.

We also included two summary tables (see next two pages) that summarize data pertinent to DFCs. The tables allow managers to quickly assess the present condition of Lee Ranger District streams relative to pertinent DFCs.

Summary Table: North Fork Shenandoah Drainage Streams

Summary of percent of total stream area in pools and total LWD per km for all streams surveyed in the North Fork Shenandoah drainage Lee Ranger District, GWJNF during summer 2001. **a** = percent area in pools ≤ 30%, **b** = percent area in pools ≥ 70%, **c** = total LWD per km ≤ 78 pieces, **d** = total LWD per km ≥ 186 pieces. Asterisk = stream survey perfomed in 2002. Small indicates stream was less than 1.0 m wide at survey starting point. NA indicates could not be calculated. Access indicates the crew could not find an access point to the stream.

Drainage	Quadrangle	Stream Name	% Pools	LWD per km
NF	Conicville	Big Stony Creek[d]	60	261
NF	Conicville	Riles Run	60	160
NF	Edinburg	Edinburg Gap Run[a,d]	15	233
NF	Edinburg	Tasker Gap[a]	16	136
NF	Edinburg	Unnamed Tributary[a]	13	110
NF	Elkton West	Fridley Run	33	90
NF	Elkton West	Left Fork Fridley Run[c]	40	78
NF	Hamburg	Big Run[a,d]	13	200
NF	Hamburg	Duncan Hollow[d]	45	215
NF	Hamburg	Mountain Run[a]	28	109
NF	Hamburg	Passage Creek (upper)	38	133
NF	Orkney Springs	Anderson Run[a,c]	19	75
NF	Orkney Springs	Bean Run (lower)[a,c]	14	63
NF	Orkney Springs	Bean Run (upper)[a,d]	22	186
NF	Orkney Springs	Bear Run*	32	79
NF	Orkney Springs	Beetle Run (lower)[c]	57	19
NF	Orkney Springs	Beetle Run (upper)[c]	NA	22
NF	Orkney Springs	Capon Run*	access	access
NF	Orkney Springs	Unnamed Stream[a,c]	15	19
NF	Orkney Springs	Falls Run[a]	16	142
NF	Rileyville	Peters Mill Run	45	113
NF	Strasburg	Passage Creek[b,c]	78	71
NF	Strasburg	Little Passage Creek (lower)[a,c]	29	18
NF	Timberville	Hottinger Hollow[b,c]	79	48
NF	Timberville	Sour Run*	access	access
NF	Timberville	Spring Run	dry	dry
NF	Timberville	Hawks Cave Run[a,c]	20	22
NF	Toms Brook	Duncan Gap	small	small
NF	Toms Brook	Mine Run[a]	26	105
NF	Toms Brook	Mill Run[a]	23	79
NF	Wardensville	Cove Run[a]	30	103
NF	Wardensville	Paddy Run	41	91
NF	Wolf Gap	Laurel Run[a,d]	24	217
NF	Wolf Gap	Little Stony Creek[a]	29	97
NF	Wolf Gap	Mill Creek[c]	31	78
NF	Wolf Gap	Poplar Run[c]	34	61
NF	Woodstock	Cedar Creek	34	185
NF	Woodstock	Cove Run[a,d]	19	259
NF	Woodstock	Narrow Passage[a]	24	148
NF	Woodstock	Sulfer Springs Gap[a,c]	13	46

Summary Table: South Fork Shenandoah Drainage Streams

Summary of percent of total stream area in pools and total LWD per kilometer for streams surveyed in the South Fork Shenandoah drainage, Lee Ranger District, GWJNF during summer 2001. **a** = percent area in pools ≤ 30%, **b** = percent area in pools ≥ 70%, **c** = total LWD per km ≤ 78 pieces, **d** = total LWD per km ≥ 186 pieces. Asterisk = stream survey performed in 2002.

Drainage	Quadrangle	Stream Name	% Pools	LWD per km
SF	Elkton West	Boone Run[a]	27	166
SF	Hamburg	Browns Run[a,d]*	11	238
SF	Stanley	Kettle Hollow[c]	32	74
SF	Tenth Legion	Cub Run[a,c]	23	74
SF	Tenth Legion	Morgan Run[a,d]	24	227
SF	Tenth Legion	Pitt Spring Run[a,c]	19	73
SF	Tenth Legion	Roaring Run[a,c]	22	60